

1 What is claimed is:

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3 1. A system for modulating DS data on an I phase communicating  
4 DI data and on a Q phase communicating DQ data, the I phase and Q  
5 phase are phases of a modulated carrier signal communicating the  
6 DI data and the DQ data and the DS data, the carrier signal has a  
7 total phase equal to arctangent of the Q phase divided by the I  
8 phase, the system comprising,

9 an encoder for encoding the DI data and the DQ data  
10 respectively into an Io encoded signal and a Qo encoded signal,  
11 an encoded subcarrier modulation signal generator for  
12 receiving one or more of the DS data and the DI data and the DQ  
13 data and for generating an encoded subcarrier modulation signal,  
14 the encoded subcarrier modulation signal comprises a product of a  
15 data partition function and the DS data, the data partition  
16 function is a function of one or more of the DI data and the DQ  
17 data and the DS data,

18 a modulator for modulating a subcarrier signal by the  
19 encoded subcarrier modulation signal for providing a modulated  
20 subcarrier signal, for modulating the total phase of the carrier  
21 signal by the modulated subcarrier signal, for modulating the I  
22 phase of the carrier signal by the Io encoded signal and by an I  
23 phase subcarrier signal to provide an I phase carrier signal and  
24 for modulating the Q phase of the carrier signal by the Qo  
25 encoded signal and by a Q phase subcarrier signal to provide a Q  
26 phase carrier signal, the modulator combining the Q phase carrier  
27 signal and the I phase carrier signal as a composite signal, the  
28 I phase subcarrier signal is an I intermodulation product of the

1 encoded subcarrier modulation signal and the  $Q_0$  encoded signal,  
2 the  $Q$  phase subcarrier signal is a  $Q$  intermodulation product of  
3 the encoded subcarrier modulation signal and the  $I_0$  encoded  
4 signal, the ratio of the  $Q$  intermodulation product over the  $I$   
5 intermodulation product is equal to the ratio of the  $I_0$  encoded  
6 signal over the  $Q_0$  encoded signal, the composite signal has a  
7 constant amplitude envelop.

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1     2.     The system of claim 1, wherein  
2           the encoder comprises:  
3           a Q encoder for encoding the DQ data into the Qo encoded  
4     signal; and  
5           an I encoder for encoding the DI data into the Io encoded  
6     signal,  
7           the encoded subcarrier modulation signal generator  
8     comprises:  
9           a data partition function generator for receiving one or  
10    more of the DI data and the DQ data and the DS data and for  
11    generating a data partition signal;  
12           a modulo two mixer for mixing the data partition signal with  
13    the DS data into a modified DS data signal; and  
14           a data encoder encoding the modified DS data signal into the  
15    encoded subcarrier modulation signal,  
16           the modulator comprises:  
17           a subcarrier generator for generating the subcarrier signal;  
18           a multiplier for multiplying the subcarrier signal by a  
19    modulation index for generating a scaled subcarrier signal;  
20           a scaling mixer for mixing the scaled subcarrier signal with  
21    the encoded subcarrier modulation signal for providing the  
22    modulated subcarrier signal;  
23           a sine and cosine subcarrier processor for receiving the  
24    modulated subcarrier signal for generating a sine subcarrier  
25    signal and a cosine subcarrier signal, the sine subcarrier signal  
26    is modulated by the DS data, the cosine subcarrier signal is  
27    unmodulated by the DS data;  
28           a carrier phase rotator for combining the sine subcarrier

1 signal and the cosine subcarrier signal with both of  $I_o$  encoded  
2 signal and the  $Q_o$  encoded signal and for providing I and Q  
3 rotated signals, the I rotated signal comprises a scaled  $I_o$   
4 encoded signal for communicating the DI data and comprises a  
5 scaled I phase subcarrier signal for communicating the DS data,  
6 the Q rotated signal comprises a scaled  $Q_o$  encoded signal for  
7 communicating the DQ data and a scaled Q phase subcarrier signal  
8 for communicating the DS data, the scaled I phase and Q phase  
9 subcarrier signals are the I and Q intermodulation products and  
10 are generated when the sine and cosine subcarrier signals are  
11 rotated and combined with  $I_o$  encoded signal to form the I rotated  
12 signal and when the sine and cosine subcarrier signals are  
13 rotated and combined with the  $Q_o$  encoded signal to form the Q  
14 rotated signal, the scaled I phase and scaled Q phase subcarrier  
15 signals are orthogonal and are the I and Q intermodulation  
16 products of the  $I_o$  and  $Q_o$  encoded signals modulated by harmonics  
17 of the modulated subcarrier signal, the I and Q rotated signals  
18 are scaled by harmonics of the scaled subcarrier signal;  
19 and,

20 a quadrature modulator for receiving the I and Q rotated  
21 signals and the carrier signal for respective I and Q phase  
22 modulation of the carrier signal by the I and Q rotated signals  
23 to provide the composite signal having the I phase and Q phase,  
24 the DI data is communicated on the I phase of the composite  
25 signal, the DQ data is communicated on the Q phase of the  
26 composite signal, and the DS data is communicated on both of the  
27 I phase and Q phase of the composite signal, the constant  
28 amplitude envelope results from the I and Q phase modulation of

1 the carrier signal by the modulated subcarrier signal.

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4 3. The system of claim 2, wherein the modulation index is less  
5 than or equal to  $\pi/2$  radians.

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8 4. The system of claim 1 wherein

9 the encoder comprises:

10 a Q encoder for encoding the Q data into the Qo encoded  
11 signal; and

12 an I encoder for encoding the I data into the Io encoded  
13 signal,

14 the encoded subcarrier modulation signal generator  
15 comprises:

16 a data partition function generator for receiving one or  
17 more of the DI data and the DQ data and the DS data for  
18 generating a data partition signal;

19 a modulo two mixer for mixing the data partition signal with  
20 the DS data into a modified DS data signal; and

21 a data encoder encoding the modified DS data signal into the  
22 encoded subcarrier modulation signal,

23 the modulator comprises:

24 a subcarrier generator for generating the subcarrier signal;

25 a subcarrier modulator for modulating the encoded subcarrier  
26 modulation signal onto the subcarrier signal to provide the  
27 modulated subcarrier signal;

28 a quadrature modulator for modulating Io encoded signal and

1 Qo encoded signal onto an IF signal for providing a quadrature IF  
2 signal;

3 a phase modulator having a modulation index for phase  
4 modulating an RF signal by the modulated subcarrier signal to  
5 provide a modulated subcarrier RF signal; and

6 a mixer for mixing the quadrature IF signal with the  
7 modulated subcarrier RF signal to provide the composite signal  
8 comprising the carrier signal that is a product of the IF signal  
9 and the RF signal.

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11 5. The system of claim 4, wherein the subcarrier signal is a  
12 sinewave signal.

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15 6. The system of claim 1, wherein,  
16 the encoder is further for setting an I phase to Q phase  
17 power ratio of power of the Io encoded signal relative to power  
18 of the Qo encoded signal, and for further setting the same I  
19 phase to Q phase power ratio of power of the Q phase subcarrier  
20 signal relative to power of the I phase subcarrier signal, and  
21 the modulator is defined by a modulation index for setting a  
22 carrier to subcarrier power ratio between the power of Io and Qo  
23 encoded signals relative to the I phase and Q phase subcarrier  
24 signals.

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27 7. The system of claim 1, wherein the subcarrier signal is a  
28 periodic signal.

1 8. A system for modulating DS data on an I phase communicating  
 2 DI data and on a Q phase communicating DQ data, the I phase and Q  
 3 phase are phases of a modulated carrier signal communicating the  
 4 DI data and DQ data, the carrier signal has a total phase equal  
 5 to arctangent of the Q phase divided by the I phase, the DI data  
 6 is communicated in spread spectrum signals spread by an CI code,  
 7 the DQ data is communicated in spread spectrum signals spread by  
 8 an CQ code, the DS data is communicated in spread spectrum  
 9 signals spread by an CS code, the DS data is subcarrier data and  
 10 CS code is a subcarrier code, the system comprising,  
 11 an encoder for encoding the DI data spread by the CI code  
 12 into an Io encoded signal, and for encoding the DQ data spread by  
 13 the CQ code into a Qo encoded signal,  
 14 an encoded subcarrier modulation signal generator for  
 15 receiving the DS data and the CS code and the DI data and the CI  
 16 code and the DQ data and the CQ code and for generating an  
 17 encoded subcarrier modulation signal, the encoded subcarrier  
 18 modulation signal comprises a product of a data partition  
 19 function and a code partition function and the DS data and the CS  
 20 code, the data partition function is a function of one or more of  
 21 the DI data and the QI data and the DS data, the code partition  
 22 function is a function of one or more of the CI code and the CQ  
 23 code and the CS code, and  
 24 a modulator for modulating a subcarrier signal by the  
 25 encoded subcarrier modulation signal for providing a modulated  
 26 subcarrier signal, for modulating the total phase of the carrier  
 27 signal by the modulated subcarrier signal, for modulating the I  
 28 phase of the carrier signal by the Io encoded signal and by an I

1 phase subcarrier signal to provide an I phase carrier signal and  
2 for modulating the Q phase of the carrier signal by the  $Q_0$   
3 encoded signal and by an Q phase subcarrier signal to provide a Q  
4 phase carrier signal, the carrier modulator combining the Q phase  
5 carrier signal and the I phase carrier signal as a composite  
6 signal, the Q phase subcarrier signal is a Q intermodulation  
7 product of the encoded subcarrier modulation signal and the  $I_0$   
8 encoded signal, the I phase subcarrier signal is an I  
9 intermodulation product of the encoded subcarrier modulation  
10 signal and the  $Q_0$  encoded signal, the ratio of the Q  
11 intermodulation product over the I intermodulation product is  
12 equal to the ratio of the  $I_0$  encoded signal over the  $Q_0$  encoded  
13 signal, the composite signal has a constant amplitude envelop.





1 12. The system of claim 11, wherein power of the Q phase and I  
2 phase subcarrier signals is less than power of the Io and Qo  
3 encoded signals modulated on the carrier signal.

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5 13. The system of claim 8, wherein the modulator comprises,  
6 a subcarrier generator for generating the subcarrier signal;  
7 a subcarrier modulator for modulating the encoded subcarrier  
8 modulation signal onto the subcarrier signal to provide a  
9 modulated subcarrier signal;

10 a quadrature modulator for modulating Io encoded signal and  
11 Qo encoded signal onto an IF signal for providing a quadrature IF  
12 signal;

13 a phase modulator having a modulation index for phase  
14 modulating an RF signal by the modulated subcarrier signal to  
15 provide a modulated subcarrier RF signal; and

16 a mixer for mixing the quadrature IF signal with the  
17 modulated subcarrier RF signal to provide the composite signal  
18 comprising the carrier signal that is a product of the IF signal  
19 and the RF signal.

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21 14. The system of claim 8, wherein the encoder comprises,  
22 a Q mixer for spreading the DQ data by the CQ code to  
23 provide a DCQ spread spectrum signal,

24 a Q encoder for encoding the DCQ spread spectrum signal into  
25 the Qo encoded signal,

26 a Q amplifier for setting a Q power level of the Qo encoded  
27 signal,

28 an I mixer for spreading the DI data by the CI code to

1 provide a DCI spread spectrum signal,  
2 an I encoder for encoding the DCI spread spectrum signal  
3 into the I<sub>o</sub> encoded signal, and  
4 an I amplifier for setting an I power level of the I<sub>o</sub>  
5 encoded signal.

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8 15. The system of claim 14, wherein the I power level does not  
9 equal the Q power level.

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12 16. The system of claim 8, wherein the encoded subcarrier  
13 modulation signal generator comprises,  
14 a data partition function generator for receiving one or  
15 more of the DS data and the DI data and the DQ data and for  
16 generating a data partition signal,  
17 a code partition function generator for receiving one or  
18 more of the CS code and the CI code and the QI code and for  
19 generating a code partition signal,  
20 a data mixer for modulo two mixing the DS data and the data  
21 partition signal into a modulo two data signal,  
22 a code mixer for modulo two mixing the CS code and the code  
23 partition signal into a modulo two code signal,  
24 a modulo two mixer for modulo two mixing the modulo two data  
25 signal with the modulo two code signal for providing a modified  
26 subcarrier data signal, and  
27 a data encoder for encoding the modified subcarrier data  
28 signal into the encoded subcarrier modulation signal.



1 products of the Io and Qo encoded signals modulated by harmonics  
2 of the modulated subcarrier signal, the I and Q rotated signals  
3 are scaled by harmonics of the scaled subcarrier signal; and  
4 a quadrature modulator for receiving the I and Q rotated  
5 signals and the carrier signal for respective I and Q phase  
6 modulation of the carrier signal by the I and Q rotated signals  
7 to provide the composite signal having the I phase and Q phase,  
8 the DI data is communicated on the I phase of the composite  
9 signal, the DQ data is communicated on the Q phase of the  
10 composite signal, and the DS data is communicated on both of the  
11 I phase and Q phase of the composite signal, the constant  
12 amplitude envelope results from the I and Q phase modulation of  
13 the carrier signal by the modulated subcarrier signal.

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16 18. The system of the claim 17, wherein the subcarrier signal is  
17 a squarewave.

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20 19. The system of claim 8, wherein the modulator comprises,  
21 a subcarrier generator for generating the subcarrier signal;  
22 a multiplier for multiplying the subcarrier signal by a  
23 modulation index for generating a scaled subcarrier signal;  
24 a scaling mixer for mixing the scaled subcarrier signal with  
25 the encoded subcarrier modulation signal for providing a  
26 modulated subcarrier signal;

27 a sine and cosine subcarrier processor for receiving the  
28 modulated subcarrier signal for generating a sine subcarrier

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1 signal and a cosine subcarrier signal, the sine subcarrier signal  
2 is modulated by the DS data, the cosine subcarrier signal is  
3 unmodulated by the DS data;

4 a carrier phase rotator for combining the sine subcarrier  
5 signal and the cosine subcarrier signal with both of Io encoded  
6 signal and the Qo encoded signal and for providing I and Q  
7 rotated signals, the I rotated signal comprises a scaled Io  
8 encoded signal for communicating the DI data and comprises a  
9 scaled I phase subcarrier signal for communicating the DS data,  
10 the Q rotated signal comprises a scaled Qo encoded signal for  
11 communicating the DQ data and a scaled Q phase subcarrier signal  
12 for communicating the DS data, the scaled I phase and Q phase  
13 subcarrier signals are the I and Q intermodulation products and  
14 are generated when the sine and cosine subcarrier signals are  
15 rotated and combined with Io encoded signal to form the I rotated  
16 signal and when the sine and cosine subcarrier signals are  
17 rotated and combined with the Qo encoded signal to form the Q  
18 rotated signal, the scaled I phase and scaled Q phase subcarrier  
19 signals are orthogonal and are the I and Q intermodulation  
20 products of the Io and Qo encoded signals modulated by harmonics  
21 of the modulated subcarrier signal, the I and Q rotated signals  
22 are scaled by harmonics of the scaled subcarrier signal, the sine  
23 subcarrier signal comprises modulation index scaled, subcarrier  
24 data modulated, odd subcarrier harmonic signals, the cosine  
25 subcarrier signal comprises modulation index scaled even  
26 subcarrier harmonic signals, the modulation index is set to a  
27 predetermined value to weight subcarrier harmonics to set power  
28 of the carrier signal relative to the subcarrier signal while

1 maintaining the constant envelop of the composite signal; and  
2 a quadrature modulator for receiving the I and Q rotated  
3 signals and the carrier signal for respective I and Q phase  
4 modulation of the carrier signal by the I and Q rotated signals  
5 to provide the composite signal having the I phase and Q phase,  
6 the DI data is communicated on the I phase of the composite  
7 signal, the DQ data is communicated on the Q phase of the  
8 composite signal, and the DS data is communicated on both of the  
9 I phase and Q phase of the composite signal, the constant  
10 amplitude envelope results from the I and Q phase modulation of  
11 the carrier signal by the modulated subcarrier signal.

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14 20. The system of claim 19, wherein the modulated subcarrier  
15 signal is equal to the modulation index multiplied by the DS data  
16 by the data partition function by the code partition function by  
17 CS code and by the subcarrier signal.